

3.0 Affected Environment

This chapter describes the physical, biological, cultural, and socioeconomic resources most likely to be affected by the proposed land exchange and expansion of Rocky Flats NWR, with a brief summary of Baca and Arapahoe NWRs. For additional information on lands elsewhere in Colorado that are proposed for exchange under Alternatives C and D, please reference the conceptual and current Comprehensive Conservation Plans for the Baca NWR and Arapaho NWRs, at http://www.fws.gov/mountain-prairie/planning/plans_co/index.html.

3.1 Physical Environment

This section describes the physical features of the Rocky Flats NWR and adjoining land within the proposed boundary expansion, including geology, climate, and anticipated climate change.

Physiographic and Geological Features

The Rocky Flats NWR sits at the interface of the Great Plains and Rocky Mountains, about 2 miles east of the foothill escarpment in Jefferson County, Colorado. The elevation of the Refuge ranges from 5,500 feet in the southeastern corner to 6,250 feet on the western edge of the adjacent section 16 property. The western half of the site is characterized by the relatively flat Rocky Flats pediment, which gives way to several finger-like drainages that slope down to the rolling plains in the eastern portion of the site.

Geological units at the Rocky Flats site range from unconsolidated surficial deposits to various bedrock layers. Surficial deposits in the western portions of the site are characterized by Rocky Flats Alluvium, clayey and sandy gravels up to 100 feet thick. The steeper slopes below the Rocky Flats Alluvium in the central portion of the site generally consist of landslide deposits. Surficial deposits in the eastern portion of the refuge consist of colluvium 3 to 15 feet thick and terrace alluvium 10 to 20 feet thick (Shroba and Carrara 1996).

Mineral resources

The Rocky Flats Alluvium is believed to be the only mineral resource feasible for development at the Refuge. Historically, uranium, coal, oil and natural gas have been extracted near the Rocky Flats site. At present, mineral leases for Rocky Flats Alluvium are held within the proposed acquisition on section 16, as well as within DOE-administered properties within the current approved acquisition boundary.

Soils

The soils at the site formed from alluvium (stream deposited), colluvium (gravity deposited), or residuum (bedrock material that weathered in place). Soils in the western half of the site formed from alluvium, while those in the eastern half of the site formed from colluvium and residuum. Soils in the western half of the site are primarily the Flatirons and Nederland soils that formed in the Rocky Flats Alluvium (Figure 5). Flatirons soils consist of very cobbly to very stony loamy surface soils and clayey subsoils. These soils are deep and well drained. Flatirons soils are located on western pediments and ridgetops, as well as the upper portions of hillsides. Nederland soils have very cobbly loamy surface and subsoils. They

are deep and well drained. Nederland soils are located on steeper hillsides and valley slopes in the western portion of the Refuge.

Soils in the eastern portion of the site consist primarily of Denver, Kutch, Midway, Valmont, Haverson, and Nunn soils. The Denver-Kutch-Midway complex consists of soils with loamy surfaces and clayey subsoils. The Denver soils are deep and well drained, the Kutch soils are moderately deep and well drained, and Midway soils are shallow and well drained. The Denver-Kutch-Midway complex is the dominant soil map unit in the eastern portion of the Refuge, although it also occurs in the western half along hillsides. Denver and Kutch soils are found on side slopes, and the Midway soils occur on steeper slopes. Valmont soils consist of deep, well-drained soils with loamy surfaces and loamy to clayey subsoils. This soil type is found in the northeast corner of the Refuge on the eastward extension of the Rock Creek/Walnut Creek drainage divide. Haverson soils are loamy soils located in floodplains or low terraces. Nunn soils consist of deep, well-drained soils on lower slopes adjacent to drainage bottoms. They have loamy surface surfaces and loamy to clayey subsoils.

Surface water

Three drainages originate on or near the Refuge: Rock Creek, Walnut Creek, and Woman Creek. Stream levels fluctuate depending on the season and amount of precipitation. Most streamflow is controlled by groundwater discharge. Streamflow is greater when groundwater levels are higher, such as in the spring. Surface sheet flow is only a significant contributor to stream flows during high precipitation events (Kaiser-Hill 2002a).

There are four ponds on the Refuge: the two Lindsay Ponds on Rock Creek and ponds D-1 and D-2 on the Smart Ditch. Several additional ponds are found within the DOE Retained Area.

The Rock Creek basin drains the northwest portion of the Refuge. This drainage has a relatively flat headwater area to the west, but has steep gullies and channels to the east where it cuts below the Rocky Flats Alluvium into bedrock formations. Rock Creek is hydrologically isolated from the rest of the site and receives no water from the DOE Retained Area. Surface water generally originates from shallow groundwater discharge as well as precipitation. Rock Creek continues off-site to the northeast, where it joins Coal Creek in the Boulder Creek basin.

Walnut Creek consists of three tributaries that drain the central portion of the Refuge, including most of the Core Operable Unit. The northernmost branch, No Name Gulch, begins at the outfall of the East Landfill Pond. The central branch, North Walnut Creek, begins at the northern edge of the Industrial Area and flows through the “A” series ponds. South Walnut Creek begins in the Core Operable Unit and collects discharge from the Rocky Flats Wastewater Treatment Plant before flowing through the “B” series ponds. The three branches converge near the eastern Refuge boundary before flowing off-site to the east. Walnut Creek is typically dry during most of the year.

The Woman Creek basin drains the southern portion of the Refuge. The Woman Creek drainage consists of two major branches that begin off of the Rocky Flats site to the southwest. The main stem of Woman Creek flows across the site, passing south of the DOE Retained Area and flowing through the C-1 pond. The Mower Ditch diverts most of the Woman Creek flow into Mower Reservoir, east of the Refuge. Typically, Woman Creek has no streamflow in late spring and summer. All surface flows are lost to

groundwater in the warmer months. In the winter, most of the baseflow is from Antelope Springs. Woman Creek is largely unaffected by pond releases from the DOE Retained Area.

A small portion of the Refuge near its southern boundary lies within the Big Dry Creek drainage, although the creek itself does not flow through the Refuge. Big Dry Creek flows into Standley Lake about 1 mile east of Indiana Street.

Besides the three principal natural drainages, several ditches cross the Refuges. The South Interceptor Ditch currently collects runoff from south of the Core Operable Unit, which channels surface runoff into the C-2 pond. The Smart Ditch originates at Rocky Flats Lake, which is to the southwest of the Refuge, then it enters the Refuge and flows through the South Woman Creek drainage for almost 2 miles before splitting off toward Standley Lake to the southeast. The Mower Ditch diverts most of Woman Creek toward Mower Reservoir to the east. The Upper Church Ditch enters Rocky Flats from the west and traverses the Rock Creek/Walnut Creek drainage divide until it exits the Refuge in the northeast corner. The McKay Ditch runs from the west side of the Core Operable Unit into the Walnut Creek drainage. The Kinnear Ditch diverts water from Coal Creek west of the Refuge and conveys it to the Woman Creek channel. The South Boulder Canal runs from north to south across section 16 and conveys water to Ralston Reservoir to the south of the Refuge.

Groundwater

Hydrogeology at the Rocky Flats NWR is characterized by three distinct units: the upper alluvial aquifer, lower aquitard, and the Laramie-Fox Hills aquifer. An aquifer is a geologic formation that has sufficient permeability to store and/or convey water. An aquitard is a confining layer with low permeability that can store water but does not allow water to readily pass through it.

The upper alluvial aquifer is comprised of unconsolidated materials, which can be as much as 100 feet thick in the western portions of the Refuge. This aquifer is generally recharged from precipitation or surface water. Groundwater in the unconsolidated alluvial aquifer is generally close to the land surface, with an average depth of 11 feet below ground surface.

The lower aquitard is composed of the deeper claystones and siltstones of the Laramie and Arapahoe Formations. Combined, these formations combined are up to 800 feet thick below the Refuge. Recharge of the lower aquitard occurs from downward flow through the upper aquifer, or directly through precipitation in areas where the bedrock is exposed. Beneath the aquitard lies the regional Laramie-Fox Hills aquifer. It is composed of the lower sandstone unit of the Laramie Formation and the Fox Hills Sandstone and is confined by the overlying aquitard. Groundwater levels in the bedrock aquifers are generally greater than 100 feet.

Several springs have emerged where the upper aquifer and the lower aquitard are exposed at the surface. While most of these springs occur within the Rock Creek drainage, Antelope Springs in the Woman Creek drainage has the largest discharge at the site. Antelope Springs discharges continuously over several acres.

Several portions of the upper alluvial aquifer east and northeast of the DOE Retained Area are known or suspected of being contaminated with radionuclides, volatile organic compounds, and metals. The aquitard is less contaminated than the upper alluvial aquifer. No contaminant plumes have been identified

in the aquitard. The Laramie-Fox Hills aquifer beneath the site is unlikely to be contaminated (IATTF 1998).

Air Quality

For air quality planning purposes, Rocky Flats is located within the boundary of the Denver Metropolitan Area. For many years, the Denver metropolitan area has experienced carbon monoxide, ozone, and particulate matter air pollution as well as visibility problems. This region is considered an air quality attainment city by the EPA (USFWS 2004a), meaning it currently meets EPA air quality standards. The Rocky Flats NWR is almost entirely in Jefferson County, Colorado. In 2008, air quality was good or moderate in Jefferson County on 264 out of 274 days for which data is available. The primary air quality concern in the region is ozone (EPA 2011).

Noise

Noise levels on the north, west, and east perimeter are affected by traffic on the highways adjacent to these locations. Because traffic volumes are higher on SH 93, noise levels are higher on the western perimeter than at other locations. Noise levels are lower on the southern perimeter because SH 72 is farther from the site boundary. Wind generators at the National Wind Technology Center (NWTC) also generate noise. The Refuge is typically a very windy location and wind noise contributes to the overall ambient noise levels. Noise levels decrease away from the area highways and NWTC wind generators (USFWS 2004a).

Climate

Rocky Flats NWR, including the proposed expansion area, lies within the semi-arid, continental climate zone (Peel et al. 2007). Temperatures range from an average high of 43°F and low of 15°F in January, to an average high of 88°F and low of 57°F in July. However, the temperatures can be much more extreme, with a record high of 105°F and a record low of -29°F. This area has low mean annual precipitation, with an average of 15 inches per year (NWS 2011). Most of the overall precipitation falls in the summer, but because of its elevation, much of the winter precipitation falls as snow.

Climate Change

Broad scale climate prediction models anticipate that the climate of Rocky Flats NWR will warm between 3-7°F by the 2080s. Regardless of the emissions scenario used in individual climate models, the amount of precipitation in the Refuge area is expected to remain about the same or slightly decrease (Maurer et al. 2007).

Physical Environment of Baca National Wildlife Refuge Inholdings

One of the properties described for Alternatives C & D is part of the 103,000 acre Medano-Zepata Ranch, owned by The Nature Conservancy (TNC). Three inholding parcels, totaling about 6,490 acres, are within the Baca NWR administrative boundary. These parcels, located in the southern portion of the refuge, are relatively close to one another.

The Baca NWR located in Saguache and Alamosa Counties in the San Luis Valley (SLV) of southern Colorado. The San Luis Valley is a high mountain desert surrounded by two 14,000 foot mountain ranges. Elevations on the valley floor average about 7,500 feet above sea level. The Baca NWR contains a highly diverse suite of habitats including desert shrublands, grasslands, wet meadows, playa wetlands, and riparian areas. Combined with other adjacent conservation-focused lands including the Great Sand Dunes National Park and Preserve, the Rio Grande National Forest, Colorado State Lands, and The Nature Conservancy, this region of the San Luis Valley contains one of the largest and most diverse assembles of wetland habitats remaining in Colorado.

The climate of the San Luis Valley is arid, with cold winters and moderate summers. Much of the valley floor receives between 7-8 inches of precipitation annually while the surrounding mountain ranges receive upwards of 60 inches. Thus water resources in the San Luis Valley are almost exclusively driven by snow melt throughout the spring and summer months for both available surface water and subsurface groundwater recharge. The Rio Grande River is the largest river bisecting the valley floor with numerous tributary streams and creek feeding in to it. Flowing onto the Baca NWR, major creeks include Cottonwood, Deadman, Crestone, and Willow Creeks. These creeks provide critical water which sustains wetland and riparian habitats and help replenish groundwater resources.

The San Luis Valley is part of the Rio Grande Rift Zone that extends from southern New Mexico north through the valley to its terminus near Leadville, Colorado. The valley is bordered on the east by the Sangre de Cristo mountain range and on the west by the San Juan mountain range. The valley floor contains deep deposits of alluvium fill material comprised of a variety of materials ranging in size from fine clays and sands to small and medium cobbles and boulders. The groundwater system is very complex containing both a confined and unconfined aquifer system. The Baca NWR is largely comprised of either shallow or deep sands where water drainage is generally rapid or cemented sands where drainage is poor. Playa wetlands are typical of the areas with cemented sands as the primary substrate.

Physical Environment of Arapaho National Wildlife Refuge Inholding

The second property mentioned in Alternatives B & C is an inholding at Arapahoe NWR known as the Yarmony Ranch. It is located in an intermountain, glacial basin south of the town of Walden, the county seat of Jackson County. The 8,200-foot elevation basin is approximately 30 miles wide and 45 miles long, and is commonly known as “North Park” since it is the most northern of three such “parks” in Colorado. The elevation in North Park ranges from slightly below 8,000 feet on the valley floor to 12,965 feet on Clarks Peak.

The climate is semiarid—characterized as having short, cool summers with an average growing season of only 43 days a year followed by long, cold winters. The mean rainfall in Walden is 10.83 inches of precipitation annually, 70 percent of which falls as snow (Lischka et al. 1983).

North Park is a structural basin between the Precambrian granites, gneisses and schists of the Medicine Bow and Park Ranges and Independence Mountain. The sandstones, conglomerates, and shales of the Tertiary Coalmont Formation dominate the surface geology of the North Park floor. Coal is found in the lower members of the formation (Hail 1968).

The Yarmony Ranch is an approximately 3,000-acre inholding located within the Arapaho National Wildlife Refuge administrative boundary. The Ranch parcel contains mostly meadow (70%) and important riparian-willow and sage upland habitat.

The water table is shallow, with the elevation of the groundwater table approximating the water-surface elevations in nearby rivers, creeks, reservoirs, and ponds. The flooded meadows and riparian area allow the Refuge and Ranch to support abundant wildlife resources, producing thousands of ducks annually, and a diverse wildlife community that is common to high mountain valleys in the central Southern Rocky Mountains.

3.2 Biological Environment

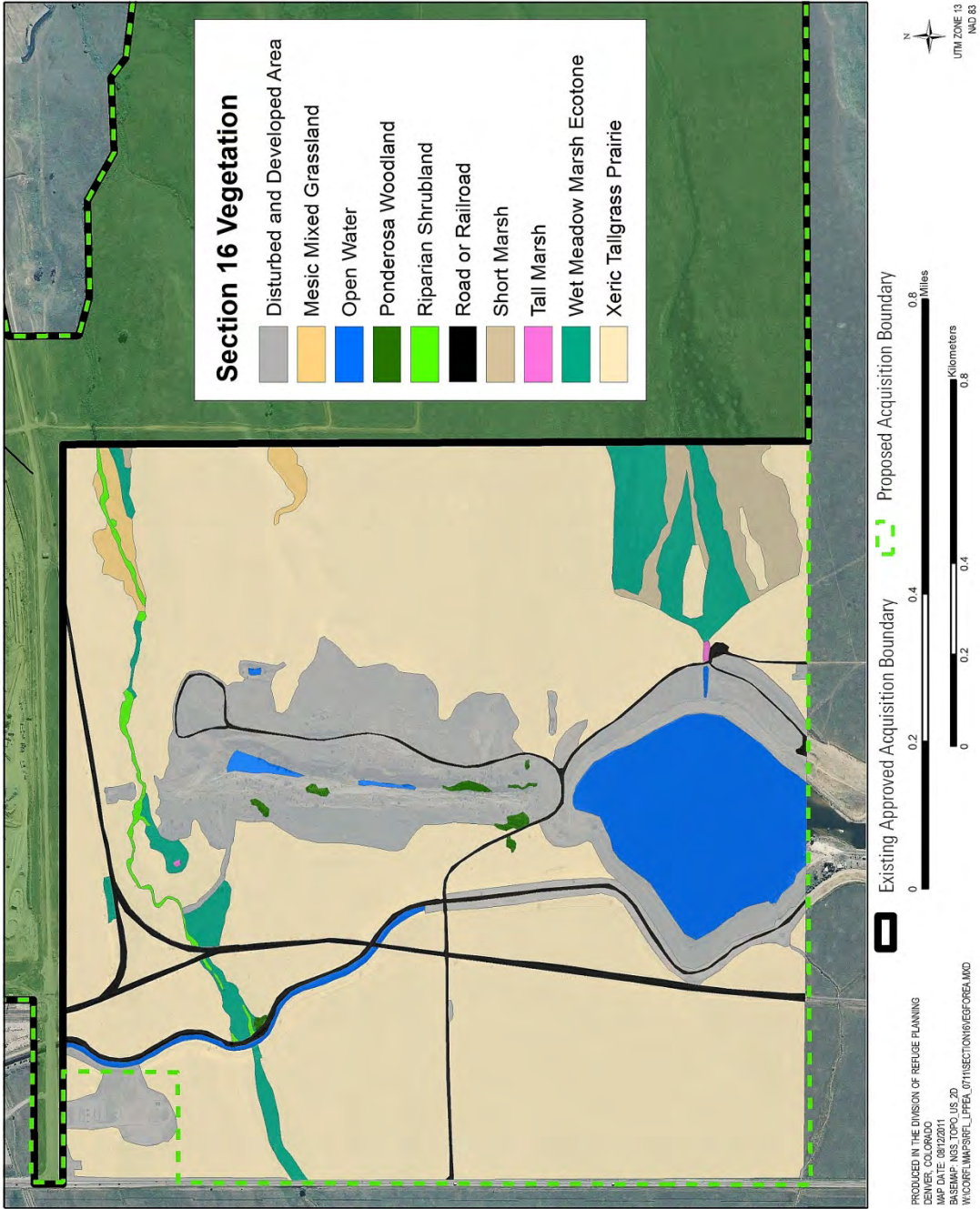
Vegetation

Rocky Flats is found in the Front Range Fans subregion within the broader high plains ecoregion. An ecoregion is a major ecosystem (a biological community of interacting organisms and their physical environment) that is defined by a distinctive geography. This area has seen substantial urbanization and other land conversion along the Front Range Urban Corridor. According to Nelson (2010), the Refuge likely serves as “a refugium for plants and animals that were once much more common.” The Refuge is home to some 630 plant species, of which 7 are considered rare or imperiled by the Colorado Natural Heritage Program (CHNP) (Nelson 2010). A diverse mosaic of vegetation communities is found at the Refuge. The dominant natural vegetation in this ecoregion is short grass prairie, which today comprises only about 20% of its original area (Robinson et al. 1995) due to land cover and land use changes associated with factors such as agriculture and urbanization. Wildlife dependent on prairie habitats are thus dependent on a substantially shrunken ecosystem.

Two of the vegetation communities present on the Refuge, the xeric tallgrass grassland and the tall upland shrubland, are considered to be rare in the region. Other significant vegetation communities include the riparian woodland, riparian shrubland, wetlands, mesic mixed grassland, xeric needle and thread grassland, reclaimed mixed grassland and ponderosa pine woodland.

Xeric Tallgrass Grassland

This rare plant community is found on the rocky plains and ridgelines in the western portions of the Refuge and in the proposed acquisition area in section 16. Covering about 2,000 acres, it contains several different plant associations that include combinations of big bluestem, little bluestem, mountain muhly, sun sedge, Fendler’s sandwort and Porter’s aster. Other tallgrass prairie species include Indian-grass, prairie dropseed, switchgrass, and needle-and-thread grass. Species richness is high; 285 species have been recorded within the xeric tallgrass community at the Refuge, of which about 80% are native. Interestingly, the big bluestem grass-dominated plant communities show a negative relationship between the age of the underlying alluvial soil and both the overall species richness and the invasibility of those habitats. Therefore, the Refuge, with its 2.2 million year old soils, has lower overall species richness but also far lower prevalence of invasive plant species than other nearby communities with younger soils (Buckner and Odasz in review). Differences in species composition are attributable to annual variations in climate and precipitation (Kaiser-Hill 2002b). The xeric tallgrass grassland is found primarily on Flatirons and Nederland soils and is believed to be a relict once connected to the tallgrass prairie hundreds of miles



The vegetation and land cover of the proposed acquisition in Section 16

to the east (Nelson 2003; Essington et al. 1996). About 5% of the plant species in this community are associated with eastern North American prairies and woodlands (Weber 1965, 1976).

The CNHP has found that much of the xeric tallgrass grasslands along the Colorado Front Range have been disturbed by urban development and agricultural conversion over the last century. In addition, aggressive weed species such as cheatgrass, Japanese brome and diffuse knapweed have degraded many areas of this community throughout the region (Essington et al. 1996). The CNHP believes that the xeric tallgrass grassland community exists in fewer than 20 places globally and that the Refuge has the largest example of this community remaining in Colorado and perhaps North America. The CNHP ranks this community as imperiled within the State (Essington et al. 1996)

The xeric tallgrass grassland community is comprised of several sub-communities (Nelson 2003). One of these sub-communities was identified by ESCO during a five-year evaluation of bluestem-dominated grasslands in the Rocky Flats area, including in the potential acquisition area in section 16. This study found that the major distinguishing feature of what ESCO calls the rare “Rocky Flats Bluestem Grassland” community is the abundance of big bluestem with little bluestem, mountain muhly, and Porter’s aster. While big and little bluestem are characteristic of midwestern tallgrass prairies, mountain muhly and Porter’s aster are characteristic of mountain environments. This unusual combination of mountain and plains grassland species in a consistent and recurring pattern across the Rocky Flats alluvial surface, along with evidence of exceptional stability, makes this vegetation community a rare, if not unique, resource (ESCO 2002).



Rocky Flats NWR and section 16 contain approximately 2,000 acres of Rocky Flats bluestem grassland.

Riparian Woodland

The riparian woodland community is characterized by a diverse mixture of plains cottonwood, peachleaf willow, Siberian elm, and coyote willow, with an understory of various shrubs such as leadplant and snowberry. It is found primarily along the drainage bottoms of the Refuge, with the most significant stand occurring in the Rock Creek drainage (Essington et al. 1996; PTI 1997).

The most significant threat to the riparian woodland community is from exotic species such as Russian olive, tamarisk, Siberian elm, Canada thistle, musk thistle, smooth brome, and Kentucky bluegrass. Preservation of this woodland community depends on the preservation of associated streamflow (Essington et al. 1996; PTI 1997).

Riparian Shrubland

Riparian shrubland forms extensive, dense thickets of shrubs along the stream bottoms of the Refuge as well as along Woman Creek in section 16. It is dominated by narrowleaf willow, coyote willow, and indigo bush and generally has an understory consisting of leadplant, Baltic rush and various sedges (Kettler et al. 1994).

Tall Upland Shrubland

Tall upland shrubland occurs on north facing slopes above seeps and along streams, primarily within the Rock Creek drainage. The tall upland shrubland consists of a rare association of hawthorn, chokecherry, and occasionally wild plum. This shrubland is associated with groundwater seeps that form at the contact of the Rocky Flats Alluvium and the underlying, relatively impermeable Arapahoe Formation. The herbaceous understory contains a number of species that are restricted to the cool, shaded microhabitat provided by the canopy. Understory species include Fendler waterleaf, spreading sweetroot, anise root, carrionflower greenbriar, fragile fern, Colorado violet, Rydberg's violet and northern bedstraw. Although the tall upland shrubland represents less than 1% of the total area of the Refuge, it contains 55% of the plant species on the site (DOE/Service 2001). This shrubland community is believed to be rare and may not occur anywhere else (DOE/Service 2001; Essington et al. 1996).

Other Shrubland

Other shrubland communities include short upland shrubland and savanna shrubland, which are found primarily in the Rock Creek drainage. Short upland shrubland is characterized by stands of snowberry and occasional Wood's rose and is often found in association with wet meadows and other wetland or riparian communities. Savanna shrubland occurs in drier areas where scattered shrubs are interspersed with grasslands. Three-leaf sumac is the predominant shrub in this community.

Wetland Communities

Wetland communities play an important role in sustaining the diverse vegetation and habitat types found on the Refuge. The two most significant wetland complexes at Rocky Flats are the seep-fed wetlands along the hillsides of the Rock Creek drainage and the Antelope Springs complex in the Woman Creek drainage. These wetlands areas are the most significant because they have the largest contiguous areas and the most complex plant associations (PTI 1997). Three wetland types, tall marsh, short marsh and wet

meadow, are found at the Refuge. These wetland types occur both in streamside areas along the valley floors as well as near the seeps and springs that occur along many of the hillsides.

Tall marsh wetlands generally occur along ponds and ditches and in persistently saturated seeps. These wetlands are dominated by cattails, bulrushes, and associated forbs such as watercress, showy milkweed, swamp milkweed and Canada thistle (a noxious weed). Antelope Springs in the Woman Creek drainage is the best example of a saturated slope wetland and tall marsh community at the Refuge.

Short marsh wetland is commonly associated with seasonally inundated or saturated areas, such as hillside seeps. Prevalent species include Nebraska sedge, Baltic rush, and spike rush as well as forbs such as watercress and speedwell.

The seasonally saturated wet meadow wetlands occur on the perimeter of saturated wetlands and contain elements of both the short marsh wetland and upland mixed grassland communities. Prevalent species include reedtop, prairie cordgrass, and solid stands of Canada bluegrass and western wheatgrass. Other species commonly found in this community include common milkweed, wild iris, Canada thistle, dock, and occasionally arnica (Nelson 2003).

Mesic Mixed Grassland

The mesic mixed grassland community is the largest vegetation community at the Refuge, covering much of the broad ridges, hillsides, and valley floors throughout the site and the rolling plains in the eastern portions of the Refuge. This community is characterized by western wheatgrass, blue grama, side-oats grama, prairie Junegrass, Canada bluegrass, Kentucky bluegrass, green needlegrass and little bluestem. This grassland occurs on clay loam soils that have relatively higher soil moisture content than other upland areas. The higher soil moisture results from subirrigation from the coarse alluvial soils, snow accumulation, and protection from wind (DOE 1997). The mesic mixed grassland is very important to wildlife species including grassland birds, small mammals and larger mammals such as mule deer.

The quality of the mesic mixed grassland habitat varies considerably across the site. In the western parts of the site, this community has been degraded by diffuse knapweed, while in the eastern portion of the site, some areas have been degraded by weed species such as Japanese brome, alysium, and musk thistle (PTI 1997).

Xeric Needle and Thread Grassland

Several patches of xeric grassland dominated by needle-and-thread grass occur in the eastern half of the Refuge. Other dominant grass species include New Mexico feathergrass, Canada bluegrass, Kentucky bluegrass, and Japanese brome (Nelson 2003). This grassland occurs primarily on the eastern extensions of the Rocky Flats pediment, an area that is characterized by very cobbly sandy loam soils. These soils are very similar to the soils that support the xeric tallgrass grassland community (Kaiser-Hill 1997). The largest expanse of needle-and-thread grassland at the Refuge occurs along the ridgetop north of the east access road.

Reclaimed Mixed Grassland

Reclaimed mixed grassland occurs primarily in the southeastern portion of the Refuge which was formerly cultivated. Most of these areas have been re-seeded with a mixture of smooth brome and intermediate wheatgrass, both introduced species. Other common species include crested wheatgrass, sweetclover, and field bindweed (Kaiser-Hill 1997).

Short Grassland

This grassland is typified by buffalograss and blue grama, both short grass prairie species (Kaiser-Hill 1997).

Ponderosa Pine Woodland

Isolated patches of ponderosa pine woodland cover 9 acres in the uppermost reaches of the Rock Creek and Woman Creek drainages near the western edge of the Refuge, as well as nearby areas in the section 16 parcel. These scattered pines represent an eastward extension of the nearby foothill forests. While much of the understory is similar to the adjacent grassland communities, other associated plants are more likely to occur in foothills environments (DOE 1997).

Disturbed and Developed Areas

Disturbed and developed areas consist of existing or former facilities associated with the previous use of the Rocky Flats site. They include roads, landfills, dams, and other facilities. They also include former facilities that have been revegetated with native and introduced grass species.

Noxious Weeds

Noxious weeds are exotic, aggressive plants that invade native habitat and cause adverse economic or environmental impacts. Since 1990, the Refuge has experienced a large increase in noxious weeds (DOE 1997). At the Refuge, the noxious weed species with the greatest potential to degrade the native plant communities and that are the most difficult to control include diffuse knapweed, musk thistle, Dalmatian toadflax, and Canada thistle. Other increasingly problematic weeds are downy brome (cheatgrass), field bindweed, and jointed goatgrass (Lane 2004). Diffuse knapweed, an aggressive tumbleweed, is currently given highest control priority. Canada thistle is common in and around most of the wetlands, musk thistle is found across mesic grasslands, and Dalmatian toadflax is common in xeric grasslands and other areas. Sulfur cinquefoil is a new invader to the area that may have already established populations on the Refuge (Lane 2004).

While the grasslands on the western part of the Refuge and section 16 currently have relatively few invasive species, possibly due to lower invasibility of these older assemblages (Buckner and Odasz In Review), this is likely to change if the threat posed by invasive species on the Refuge is not addressed.

Rare Plants

No Federally listed plant species, such as the Ute ladies'-tresses orchid or Colorado butterfly plant, are known to occur at the Refuge. Aside from the rare xeric tallgrass prairie and tall upland shrubland communities, the Refuge also supports populations of four rare plant species that are listed as rare or

imperiled by the CNHP. These species are the mountain-loving sedge, forktip three-awn, carrionflower greenbriar, and dwarf wild indigo. Forktip three-awn primarily occurs in previously disturbed sites near the western edge of the DOE Core Operable Unit. The other three species occur primarily along the pediment slopes in the Rock Creek drainage (Kaiser-Hill 2002b).

Fire History

Historical documentation indicates that the grasslands in the Rocky Flats area have been subjected to lightning and human-caused fires for thousands of years (DOE 1999). These fires likely played a major role in promoting native vegetation growth and diversity (DOE 1999). Since 1972, wildfires have not been allowed to burn and only one controlled burn has been conducted in the grasslands at the Refuge. As a result, a fuel load of dead vegetation has been building up in the grasslands of Rocky Flats for almost 30 years. This buildup of dead vegetation has contributed to an invasion of noxious weeds on the site, particularly in the last 10 years (DOE 1999).

Several wildfires have been documented on the site since 1993. In 1994, the Spring Grassland fire burned 70 acres between SH 128 on the north boundary and the north access road. In 1996, the 104-acre Labor Day Grassland Fire burned much of an area penned in by access roads in the southern portion of the site. In February 2002b, a 27-acre fire burned through portions of the Rock Creek drainage on the south side of SH 128. A 48-acre prescribed burn was conducted on April 6, 2000. The prescribed burn took place in the same area as the 1996 wildfire (Kaiser-Hill 2002). A fire caused by a faulty power line burned 852 acres on Rocky Flats and another 140 acres outside of Federal ownership (USFWS 2006). The most recent fire burned between 10-15 acres on September 28, 2011 (Dixon, pers. obs.)



A recent wildfire on September 28, 2011, was actively suppressed at less than 15 acres.

Wildlife Resources

Many areas of the Refuge have remained relatively undisturbed for the last 40 to 60 years, allowing them to retain diverse habitat and associated wildlife communities. These wildlife communities are supported by the regional network of protected open space that surrounds the site on three sides, buffering wildlife habitat from the surrounding urban development.

Mammals

One of the most abundant and conspicuous mammal species at the Refuge is the mule deer. A resident herd of about 160 individuals inhabits the site. In the spring, mule deer prefer woody habitat followed by grasslands. In summer, deer use is typically divided among a more diverse range of habitats. In the fall, mule deer primarily use woody habitats, with grasslands also being important. In the winter, mule deer are commonly observed in grasslands and tall upland shrublands (Kaiser-Hill 2001).

Whitetail deer have become more common at the site and are often observed in company with mule deer. The Refuge is in the Colorado Parks and Wildlife (CPW; formerly known as the Colorado Division of Wildlife [CDOW]) Game Management Unit (GMU) #38 and is adjacent to GMU#29, which collectively make up the Boulder deer herd. Elk actively use the Refuge, possibly for calving, and at least two herds are using the Refuge (M. Dixon, personal observation).



Rocky Flats provides important elk habitat, particularly for cows and calves

Other mammals observed at the Refuge include desert cottontail, white-tailed jackrabbits, blacktailed jackrabbits, muskrat, and porcupine. Muskrats generally occur in and around the ponds, while porcupine

populations are limited to the shrubland and ponderosa pine habitats in the upper Rock Creek drainage (DOE 1997). Porcupines are also likely to occur in the ponderosa pine woodland on section 16. Black-tailed prairie dogs once inhabited the Refuge in limited numbers but were largely extirpated from the Refuge by a plague outbreak in the early 2000's. Numerous small mammal species, such as mice and voles, inhabit all vegetation community types at the Refuge. Preble's meadow jumping mouse, a threatened species, is described below.

Two commonly observed carnivore species at the Refuge are coyote, which occurs throughout the site, and raccoon, which is often seen in the DOE Core Operable Unit and near watercourses. Three to six coyote dens on the Refuge support an estimated 14 to 16 individuals at any given time (Kaiser-Hill 2001). Twenty-two historic coyote dens used between 1991 and 2002 have been identified at the Refuge. The coyote dens generally occur on hillsides near watercourses. Six dens were active in 2002. One active den was located in the upper Rock Creek drainage, two were located on the slopes above either side of Walnut Creek near Indiana Street, one was near the D-1 pond, one was near Antelope Springs, and one was in the upper South Woman Creek drainage (Nelson 2003). Other carnivores include striped skunk, gray fox, red fox, long-tailed weasel, American badger, and mink. Black bears and mountain lion tracks are occasionally seen at the site (Kaiser-Hill 2000; 2001).

Birds

The most commonly observed raptors at the Refuge are red-tailed hawk, great horned owl, and American kestrel. Other less abundant raptors include Swainson's hawk, prairie falcon, and long-eared owl. Most raptor species use riparian woodlands or tall upland shrublands for nesting and roosting habitat and forage in all habitats at the site. In addition, the burrowing owl (Colorado threatened) has been observed using grasslands, and the ferruginous hawk uses riparian areas of the Refuge (PTI 1997; DOE 1997).

More than 185 species of migratory birds have been recorded at the Refuge, of which about 75 are believed to breed at the site. Of the estimated 100 neotropical migrants (migratory birds that breed north of the U.S./Mexico border and winter south of the border) at the Refuge, about 45 are confirmed or suspected breeders at the site (PTI 1997).

Commonly observed bird species in wetland habitats include the red-winged blackbird, song sparrow, common yellowthroat, and common snipe. Common birds in riparian woodland areas include the northern oriole, American goldfinch, house finch and yellow warbler. The tall upland shrubland habitat is inhabited by the song sparrow, rufous-sided towhee, black-billed magpie, yellow-breasted chat, and black capped chickadee. Common grassland birds include the vesper sparrow, western meadowlark, grasshopper sparrow, and mourning dove (DOE 1997). The reclaimed mixed grassland provides habitat for birds such as the western meadowlark and vesper sparrow (PTI 1997). Several waterfowl species use the ponds at the Refuge. The most common waterfowl are mallards and Canada geese (DOE 1997). Great blue herons feed in mudflats and short marshlands, while double-crested cormorants are common summer residents.

Reptiles and Amphibians

In general, reptiles and amphibians are found in small numbers at the Refuge due to an absence of suitable habitat. The most common reptiles are the bullsnake, yellow-bellied racer, plains garter snake, and prairie rattlesnake. All of these species occur in the open grassland habitats, although the plains garter

snake typically lives close to water bodies. Other reptiles include the short-horned lizard which occurs in open grasslands, the eastern fence lizard which occurs in rocky shrublands, and the western painted turtle which occurs in Refuge ponds (DOE 1997) and in the clay mine pool on Section 16 (M. Dixon, personal observation). The most abundant amphibian at the Refuge is the boreal chorus frog, which breeds in water bodies throughout the site. The northern leopard frog is less common and is found only in permanent water bodies such as ponds (DOE 1997). The boreal chorus frog is relatively abundant in the streams and wetlands at the Refuge (Kaiser-Hill 2000). Other amphibians include the bullfrog, Woodhouse's toad, plains spadefoot, and tiger salamander (DOE 1997).

Aquatic Species

Aquatic species at the Refuge are limited in drainages and ditches by low and irregular flows. The most common aquatic macroinvertebrates (aquatic insects) are the larvae of the blackfly, midge and mayfly (DOE 1997). Other species include caddisflies, crane flies, and damselfly larvae, as well as snails and amphipods. Large macroinvertebrates such as crayfish and snails are potentially important prey for fish, waterfowl, and mammal species.

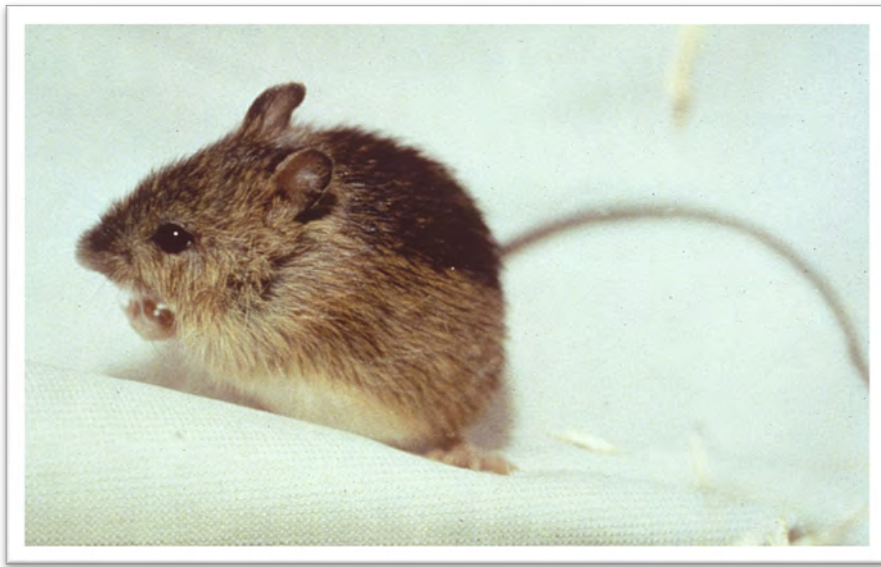
Each of the three primary drainages at the Refuge contains a variety of pond and stream habitats, varying amounts of habitat modification, and seasonal water flows. The Walnut Creek drainage has been highly modified as part of the development of the Refuge. The upper section of the drainage was filled and the lower section was modified into a series of small reservoirs that can retain water released from the Industrial Area. A variety of non-native fish species (rainbow trout, carp, and bass) were introduced into the Walnut Creek reservoirs. Although all introductions did not establish reproducing fish populations, carp, goldfish, and fathead minnows are present in these reservoirs. Woman Creek retains a significant amount of stream habitat and holds the majority of Refuge fish species. Native fish species that reproduce within Woman Creek include white suckers, fathead minnows, green sunfish, stonerollers, and creek chubs. Two nonnative fish species, golden shiners and largemouth bass, also are found in the drainage.

Three Refuge fish species are considered imperiled by the CPW: the redbelly dace (endangered), the Iowa darter (special concern), and the common shiner (threatened) (CDOW 2011). Threats to these species include extirpation through habitat degradation (e.g., siltation, pollution and/or bank destabilization), the effects of urbanization, and predation by introduced non-native fish.

Special Status Species

Preble's Meadow Jumping Mouse

Preble's meadow jumping mouse occurs in every major drainage on the Refuge. Listed as a threatened species in 1998, the mouse occurs in habitat adjacent to streams and waterways along the Front Range of Colorado and southeastern Wyoming. At the Refuge, Preble's meadow jumping mouse has been found in wetlands and shrubland communities adjacent to the Rock Creek and Woman Creek drainages. Approximately 1,108 acres on 12 miles of Rock, Walnut, and Woman creeks are designated as critical habitat (USFWS 2010).



Preble's meadow jumping mice inhabit the riparian corridors of the Rocky Flats area

Bald Eagle

The bald eagle occasionally forages at the Refuge although no nests have been identified. An active nest is located to the east of the Refuge near Standley Lake. Eagles feed primarily on fish and waterbirds but also on small mammals and mammal carcasses (DOE/Service 2001). The bald eagle was Federally listed as endangered in 1967 was downlisted to threatened in 1994, and was officially delisted from the Endangered Species Act on August 8, 2007 (72 FR 37346). The bald eagle remains a special status species due to its ongoing protections provided under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act.



Bald eagles nest near the refuge and are occasionally observed hunting in Rocky Flats

Burrowing Owl

The burrowing owl has a broad range across North and South America, but it is listed as threatened by the state of Colorado because of habitat loss due to suburban development and agriculture along the Front Range (CDOW 2011). Colorado's burrowing owls are present from April to October, and in the months between, they migrate to Mexico and Central America. The burrowing owl is found in grassland areas of the Refuge where it roosts in burrows, particularly those of prairie dogs. Due to the recent decline in prairie dogs on the Refuge, its range on the Refuge may be restricted relative to its historic use of the area. Burrowing owls feed primarily on invertebrates and small vertebrates.



Burrowing owls often roost in prairie dog burrows, but are presently uncommon at Rocky Flats because of a decline in black-tailed prairie dogs on the Refuge

Biological Environment of Baca National Wildlife Refuge Inholdings

The vegetation communities within the three Baca NWR inholding parcels mentioned in Alternatives C & D are described in detail in Salas et al. 2010. These three TNC parcels are largely comprised of open to moderately dense shrub steppe or shrublands dominated by rabbitbrush occurring widely on the stabilized sand sheet and sand ramp. Intermixed within the rabbitbrush is black greasewood and winterfat. Herbaceous species include Indian ricegrass, needle and thread, Sandhill muhly and alkali sacaton. As the shrubland community transitions into herbaceous dominated community types, species such as Indian ricegrass and needle and thread are much more common. Mesic meadows, emergent marshes, and playa wetland also comprise a portion of the parcels with species like sedges, Baltic rush, saltgrass, and western wheatgrass occurring throughout.

These vegetation communities support a variety of migratory birds including grassland songbirds, shrub-obligate species such as Brewer's sparrow and sage thrasher, and wetland-dependent birds such as American avocets, white-faced ibis, sandhill crane, and numerous waterfowl species. Other wildlife species known to occur in these habitats include rare species such as slender spiderflower, a silky pocket mouse, and a sandhill skipper (butterfly). These species occur throughout the transition areas between playa and wet meadow habitats and the surrounding upland grassland and shrub habitats. Slender spiderflower is locally abundant on Baca NWR and surrounding lands, however, it has very limited a range outside of the San Luis Valley (Rondeau et al 1998). Elk, pronghorn, and coyotes are also common throughout the refuge including these parcels.

Biological Environment of Arapahoe National Wildlife Refuge Inholding

The inholding in Arapahoe NWR provides quality habitat for many birds common to the sage-brush steppe including sage thrasher, Vesper sparrow and Brewer's sparrow. Greater sage-grouse are common, and provides critical feeding areas for sage grouse young. Mammals using the sage habitat include white-tailed prairie dogs, Wyoming ground squirrel, and pronghorn.

The Illinois River, which is tributary to the Michigan River, supports 7 species of native and non-native fish. Willow flycatcher, yellow warbler, black-crowned night-heron, sora, along with moose, river otter, beaver and wintering elk extensively use the riparian and willow habitat found along the river.

Moose, mule deer, elk and pronghorn are common. These animals migrate between the Refuge, Ranch and adjacent areas, with an average of 1200 elk, 200 pronghorn and 20 moose inhabiting the area at any one time.

Special Status Species

Species that are known, or believed to occur in Jackson County, and possibly on the Ranch and Refuge, include; American wolverine (candidate), piping plover and Canada lynx (threatened); and least tern, (endangered). An endangered plant, North Park phacelia is found on the Refuge and several other areas in Jackson County. A number of species of State concern are found in the area include western burrowing owl, ferruginous hawk, long-billed curlew, peregrine falcon, northern leopard frog, and American white pelican.

3.3 Cultural Resources

The following brief summary of the prehistory and history of the Rocky Flats NWR region is primarily an abridgment of the extensive background research done as a part of the archaeological investigations for the then-proposed Northwest Parkway (Painter et al. 2005). Additional detailed information is available in that publication and in the numerous sources cited as a part of that research.

Prehistory

Current archaeological evidence indicates that the earliest humans migrated to the Rocky Flats NWR region near the close of the last ice age approximately 14,000 years ago. The sites and artifacts left by these early peoples are divided into five general stages:

Paleoindian	12,000 BC – 5,700 BC
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Archaic	5,700 BC – AD 150
Late Prehistoric	AD 150 – AD 1540
Protohistoric	AD 1540 – AD 1750
Early Historic	AD 1750 - 1850

Artifacts from the Paleoindian stage provide the earliest evidence of human occupation in Colorado. The traditional view of the Paleoindian pattern emphasizes a nomadic culture tied to the migration of large game, most notably extinct “Pleistocene megafauna,” such as mammoth and *Bison antiquus*. Recent studies, however, indicate that Paleoindians also exploited smaller game, fish, and waterfowl, although on a much reduced scale (Kuehn 1998; Walker 1982; Wheat 1979; Wilmsen and Roberts 1978). Perhaps the most readily recognized stone tools in the Americas are associated with the Paleoindian stage, specifically the well-crafted, large, lanceolate, and often fluted projectile points (i.e., large, longitudinal flake scars extending from the base of the point along its centerline). Paleoindian lithic assemblages are composed predominantly of flaked stone tools believed to have been used primarily for hide and meat processing. Population densities were low during the Paleoindian stage, and therefore sites (particularly camp sites) dating to this period occur less frequently than those of the subsequent stages.

The Archaic stage is marked by an increasingly diverse subsistence base, an extensive feature assemblage, and a variety of stone tool and projectile point styles. The beginning of the Archaic stage coincides roughly with the onset of the Altithermal climatic episode (approximately 7,000 BC - 4,000 BC): a prolonged period of general warming and drying in western North America (Frison 1991). The change in weather patterns and environments resulted in the total replacement of Pleistocene fauna with generally modern species. Collected wild plant foods made up a significant portion of the human diet during the Archaic stage and small mammals, reptiles, and even insects were eaten. Ground stone implements used to process floral material such as nuts, seeds, berries and fruits became common. Stone boiling pits, storage cists, and architectural features such as basin houses are also associated with the Archaic stage and are likely the result of increasing population density and a general shift toward increased levels of sedentism (Frison 1991; Metcalf and Black 1991; Shields 1998). Archaic projectile points are generally large and often are not as well crafted as points of the preceding Paleoindian stage.

The Late Prehistoric stage is generally defined as the time from the introduction of the bow and arrow and the start of the use of pottery to the earliest contacts of the native population with Europeans. Throughout the region this was a time of important changes in economic patterns, artifact complexes, and population distribution. During this stage material traits and possibly certain economic patterns believed native to areas farther east were adopted by the local hunter-gatherers. This time period coincides with the introduction of the bow and arrow, and, although large spear points are associated with the early years, the most distinctive lithic characteristic of the period is the small triangular projectile point. A range of habitation sites with structures has been recorded in eastern Colorado, but there is no evidence of permanently settled horticultural villages. Ceramics are varied but in general consist of cord-marked jars. Bone artifacts are common and include awls, fleshers, wrenches, and beads. Ground stone is abundant and varied, including not only manos and metates but also shaft abraders.

The Protohistoric stage encompasses the span of time between the earliest European influences on the Native Americans and the onset of regular, direct contacts between Native Americans and Euro-Americans. The AD 1540 date for the beginning of this stage corresponds with Coronado’s first expedition to the Southern Plains of North America and, although the Spanish did not make it to the Rocky Flats region, it is the beginning of potential influences. Euro-American incursions into the central

and western high plains are known to have occurred on an infrequent basis during the latter half of the 18th century. External pressures in addition to the introduction of the horse and other material goods led to accelerated changes to the traditional cultures. A nomadic, equestrian lifestyle emphasizing bison hunting, generally with firearms, became pervasive among tribes occupying eastern Colorado. The circular arrangements of rock often associated with Protohistoric sites are thought to be primarily the remnant “footprints” of tipi structures - representing rock weights used to secure the structure coverings.

Much more information is available for the post-AD 1725 periods. Most notably, historically identifiable tribes established a presence in the region. Historical records indicate that this particular span of time is characterized by successive incursions and retreats by various tribes. By 1725, incursions by Comanches and their Ute allies had forced the Apache to withdraw from Colorado. The short-lived Ute/Comanche alliance that successfully pushed the Apache south disintegrated by the late 1740s (Anderson 1989:34). The Comanche subsequently controlled southeastern Colorado until they were pushed south by the Kiowa and Kiowa Apache in the late 1780s (Jones et al. 1998). A later alliance among the Comanche, Kiowa, and Kiowa Apache was, in turn, challenged by Cheyenne and Arapaho entering the region in the first quarter of the nineteenth century. Although the Ute remained the primary occupants of the mountainous regions, the Shoshone and various plains-oriented groups were known to have used the mountains on a more limited basis. During this rather turbulent period of history, however, trade networks between Native American and Euro-American groups became well established despite the ongoing hostility.

History

Although Euro-Americans had been in the area sporadically for several decades, in 1806 the U.S. Government funded the first major expedition to investigate central and southern portions of the newly acquired Louisiana Purchase. Led by Lieutenant. Zebulon Pike, the expedition explored both the Arkansas River and South Platte River basins and, along the eastern slope of the Rocky Mountains, came as far north as the Colorado Springs area before heading west. After Pike’s foray, the next significant expedition to the Front Range area occurred in 1820. Commanded by Major Stephen H. Long of the U.S. Army, the exploration had a decided scientific emphasis and traveled west along the South Platte River to the foothills before heading south. The first accounts of the Denver area and the foothills to the west were provided by the Long expedition. It is interesting to note that neither man ever set foot on the peaks that were later named after them.

The 1820s and 1830s were also characterized by a flourishing fur trade. Notable mountain men such as Andrew Sublette and Louis Vasquez exploited the abundant animal resources present along the Front Range. Vasquez and a band of trappers are reported to have camped at the confluence of the South Platte River and Clear Creek (known originally as the Vasquez River or Vasquez Fork), and from there followed Clear Creek to its source in the mountains. The booming fur trade led to the establishment of a series of trading posts bordering the eastern flanks of the Rocky Mountains from southeastern Colorado to southeastern Wyoming. By the early 1840s, a growing scarcity of beaver and changes in European fashion led to a significant decrease in the fur trade.

Throughout much of the 1850s, the Colorado Piedmont and adjacent foothills remained devoid of permanent settlements. The discovery of gold quickly changed this situation. Gold was reportedly first found along the Front Range creeks sporadically during the late 1840s and early 1850s (Mehls 1984:33), particularly by miners on their way to the gold fields of California. However, the 1858 discovery of gold

near the confluence of the South Platte River and Cherry Creek provided the initial impetus for large-scale mining in the region (Ubbelohde et al. 1995:56-57).

During the initial gold rush years, northeast Colorado above the fortieth parallel (Baseline Road in Boulder, Colorado) was included within the Nebraska Territory, and the portion below the fortieth (which includes Rocky Flats) parallel was part of the Kansas Territory. Colorado was proclaimed an official territory by the U.S. Congress after Kansas entered the U.S. in 1861 and became the 38th State in 1876.

Towns such as Golden, Boulder, and Arvada (known for being the “Celery Capital of the World”) sprang up in the areas surrounding the Rocky Flats NWR. Transportation networks consisting primarily of trails and later roads and railroads connected the growing population with the agricultural, mining, and ranching products produced throughout the State. Based on the U.S. Census the Denver Metro area, consisting of the seven counties of Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson, and (after 2001) Broomfield, had a combined population of 186,987 people in 1900, 615,645 people in 1950, and 2,784,228 people in 2010.

The growing numbers of settlers and gold miners led to increasing conflicts with the Native American populations. A series of clashes culminated in both the 1864 massacre at Sand Creek, where more than 100 Native American men, women, and children were killed, and the sacking of Julesburg, Colorado, by Cheyenne, Arapaho, and Sioux attackers the following year (Anderson 1989). Finally, the diminution of bison herds and continuous strife, in combination with disease and hunger, took its toll on the Native American population. The Medicine Lodge Treaties of 1867 provided for the final removal of the various Plains tribes to reservations located primarily in Oklahoma.

History of the Rocky Flats Plant

There are numerous documents and publications that provide a detailed history of the Rocky Flats Plant. There is also a diverse range of opinions and emotions concerning that history. Only a brief review of key events is presented here but additional details are available through several on-line and hardcopy publications. A list of these resources is available on the Rocky Flats Stewardship Council web page: http://www.rockyflatssc.org/rockyflats_history.html.

The Rocky Flats Plant was approved for construction in March 1951 with the primary mission of building triggers for nuclear weapons. Ground was broken in July of that year and by April 1952 the Plant was fully operational. A major fire in 1969 heightened the public’s awareness of the possible dangers and a 1989 raid to investigate environmental crimes led to a temporary closure that became permanent in 1992. A twelve-year cleanup process began in 1993. The Rocky Flats National Wildlife Refuge Act of 2001 set forth the creation of the refuge following the completion of the clean-up. In July of 2007 the Refuge, covering nearly 4,000 acres, was officially established.

The following information outlines some important features of the Plant (HAER CO-83):

- There were 436 structures including 150 permanent buildings and 90 temporary trailers.
- The original site was 1,900 acres and an additional 4,600 acres were purchased in 1972.

- From 1951 to 1975 the Plant was operated under the Atomic Energy Commission; from 1975-1977 the Energy Research and Development Administration; and from 1977 to 1992 the DOE.
- In 1951 the Plant employed 133 people; 1,059 employees by 1953; 3,000 employees between 1957 and 1963; 3,700 employees in 1970; 2,750 employees in the mid-1970s, 6,000 employees during much of the 1980s, 7,100 employees in 1991.

Previous Cultural Resource Investigations in Proposed Divestiture Lands

The Refuge was created in 2007 from lands that were once a part of the Rocky Flats Plant. Prior to the establishment of the Refuge, the DOE, through the private firm of EG&G who was operating the Plant at the time, hired the environmental consulting firm of Dames & Moore to conduct a cultural resource inventory of all accessible lands on the Plant. That survey and the subsequent report include the 300-foot-wide strip of land currently proposed for divestiture (Dames and Moore 1991). Information from earlier surveys is incorporated into the findings of the 1991 report.

The following table summarizes information concerning the cultural resources located within the 300-foot-wide strip of land. The information is based on Figure 3 of the 1991 report and a review of information on the Colorado Office of Archaeology and Historic Preservation on-line database (Compass) on August 1, 2010. The eligibility information refers to the National Register of Historic Places (NRHP). These results are typical of investigations in the region: there are few sites, mostly from the historical period, and they are not eligible for the NRHP.

SITE #	SITE NAME	LOCATION IN PROJECT AREA	DETERMINATION OF NRHP ELIGIBILITY
5JF512.1	Upper Church Ditch	Section 1, northeast corner of project area	Officially Not Eligible February 28, 1992
5JF513.1	McKay Ditch	Section 1, south 1/3	Officially Not Eligible February 28, 1989
5JF734.1	Mower Ditch	Section 13, north 1/3	Officially Not Eligible August 26, 1992
5JF484	Stone House – Church Ranch	Section 13, north 1/2	Officially Not Eligible July 20, 2006
5JF514.3	Smart Ditch	Section 13	Officially Not Eligible February 28, 1989

The divestiture of Federal land constitutes an undertaking under section 106 of the National Historic Preservation Act (NHPA). On August, 25, 2010, as a part of the review process required by NHPA, the Service initiated consultation with the Colorado State Historic Preservation Officer (SHPO) with a letter recommending that no further cultural resource work was necessary as the land was previously surveyed and no historic properties were located. The SHPO responded on September 8, 2010 noting that the previously recorded linear resources (ditches) in the project area were recorded prior to the establishment of the current standards and requesting that the ditches be reconsidered. Three possible options for protection or re-evaluation of the resources were outlined in the letter. The Service decided to make use of the third option and re-evaluate the linear resources.

In October of 2010, Dr. John Hofferger of Historic Preservation Consultants completed the necessary re-evaluations. In discussions with Shin duVail (SHPO staff) it was decided that two resources, the Upper Church Ditch segment (5JF512.1) and the McKay Ditch segment (5JF513.2) would be re-evaluated. Both of the re-evaluated segments are in poor condition and neither supports the NRHP eligibility of the ditch. These findings were sent to the SHPO on November 1, 2010, with a request for their concurrence. The SHPO concurred with the finding of no adverse effect for the proposed land disposal on November 5, 2010.

Previous Cultural Resource Investigations in Section 16

Section 16 (Township 2 south, Range 70 west) is what is often referred to as a “school section.” School sections were initially established under the Federal Land Ordinance of 1785 which set aside section 16 of each township to provide income and, in some cases, a location for local schools. As western states were admitted to the Union, section 36 in each township was also established as a school section. The section 16 in question was designated a school section when Colorado became a state in 1876. The section is referred to as the Rocky Flats school section and is part of the State Trust Lands managed by the Colorado State Board of Land Commissioners.

There has been one cultural resource survey done in section 16. In January of 1998, the Colorado Department of Transportation archaeological staff surveyed the very disturbed SH 93 transportation corridor through the section in preparation for proposed shoulder work. No cultural resources were located (Hand 1998).

A cultural resource survey was also done for the 35-mile long proposed W470 corridor in 1988 and 1989. The corridor was located just south of section 16. No cultural resources were located in the vicinity, however most of the corridor in the Rocky Flats area was excluded from the survey (Joyner 1989).

3.4 Socioeconomic Environment

The Rocky Flats NWR is at the intersection of Jefferson, Boulder, and Broomfield counties, in the northwest portion of the Denver metropolitan region. It is surrounded by open space to the north, east, and west and urban development to the northeast and southeast. Although there are no active developed uses within the Rocky Flats NWR, the DOE does retain some land within the middle of the site. Other nearby land uses include mining operations, wind energy research, and water collection and storage facilities.

Surrounding Communities

Five principal cities and towns (Arvada, Westminster, Broomfield, Superior, and Boulder) are located within close proximity to the Rocky Flats NWR. The general land uses of those portions of these municipalities located near the site are described below.

- The City of Arvada is located southeast of the Refuge. While most of Arvada’s residential and commercial development is over 1 mile from the Refuge, the City’s incorporated boundary directly abuts the site. A large area immediately south of the Refuge and east of SH 93 has been annexed by the City and is planned for residential and mixed development. This area, known as the Vauxmont property, is currently vacant and used is for livestock grazing.

- The City of Westminster is located directly east of the Refuge and north of Arvada. However, most of the western portions of Westminster's incorporated area consist of open space, including the Westminster Hills Open Space which is being restored as a native grassland and prairie dog habitat. Residential land uses begin about 1.5 miles east of the Refuge.
- The City and County of Broomfield is located immediately east and northeast of the Refuge. The area to the east is dominated by open space associated with Great Western Reservoir and undeveloped land. Other portions of this area are planned for development supporting office complexes. An existing office complex is located about 1 mile northeast of the Refuge on the north side of SH 128.
- The Town of Superior is north and northeast of the Refuge's northeastern corner. Existing residential areas are about ¼ mile north of the Refuge and future residential developments are proposed for the area. Superior's town center is located about 2 miles north of the Rocky Flats NWR boundary.
- The City of Boulder is north and west of the Refuge's northwestern corner. Much of the open space adjacent to the Refuge in this general area is owned or managed by the City of Boulder as open space, both for recreational and wildlife habitat purposes. The Flatirons Vista and Greenbelt Plateau trail systems are located in areas adjacent to the northern boundary of the Rocky Flats NWR.

Population and Demographics

The population in Jefferson County grew from 527,056 in 2000 to 534,543 in 2010 (U.S. Census Bureau), a total increase of 7,487 people. Population in the County is projected to continue growing over the long term, and reach more than 700,000 by the year 2040 (Colorado State Demography Office).

The communities nearest to Rocky Flats NWR also exhibit strong growth trends. The surrounding communities have experienced tremendous growth over the past several years and this trend is expected to continue. This anticipated growth is considered in city, county, and regional plans. Census data for these communities can be found in the table below.

CITY / TOWN	2000 POPULATION	2010 POPULATION	CHANGE BETWEEN 2000 AND 2010	
			#	%
Arvada	102,153	106,433	+4,280	+4.2%
Boulder	94,673	97,385	+2,712	+2.9%
Broomfield	38,272	55,889	+17,617	+46.0%
Superior	9,011	12,483	+3,472	+38.5%
Westminster	100,940	106,114	+5,174	+5.1%
Total	345,049	378,304	+33,255	+9.6%

Within the surrounding communities noted in the table above, approximately 80% consider themselves to be non-Hispanic whites (Census 2010). Within the communities, approximately 13% of the population is Hispanic, with the highest proportion (21%) in Westminster.

Employment

As designated by the State of Colorado, Rocky Flats NWR is located in the Tri-County Workforce Region (Jefferson, Gilpin, and Clear Creek Counties). In June 2011, the average unemployment rate for this area was 8.3%, while the State average was 8.7% (Colorado Department of Labor and Employment). In the fourth quarter of 2010, the largest employment sectors were retail trade (29,098 employees), health care and social assistance (22,974), and accommodation and food services (21,901). (Colorado Department of Labor and Employment 2011).

WORKFORCE REGION	NUMBER EMPLOYED	NUMBER UNEMPLOYED	UNEMPLOYMENT RATE
Boulder	160,804	11,986	6.9%
Broomfield	28,069	2,429	8.0%
Tri-County (Jefferson, Gilpin, Clear Creek)	284,143	25,668	8.3%
Colorado	2,687,828	2,453,351	8.7%

Income

In 2009, per capita personal income was \$45,834 in Jefferson County, a 2.8% annual increase since 1999. Total personal income in Jefferson County was \$24.6 billion in 2009, up from about \$18.3 billion in 1999, reflecting an average annual growth rate of about 3.0% (Bureau of Economic Analysis).

In 2008, median household income in Jefferson County was \$66,627. This was 9% higher than the median household income across Colorado, and 32% higher than the median figure for the United States as a whole (Colorado Department of Labor and Employment). These figures are also substantially higher than Federal poverty thresholds for the same year. In 2008, Federal poverty thresholds for households of two and three persons were annual income of \$14,051 and \$17,163, respectively (U.S. Census Bureau).

COUNTY	TOTAL PERSONAL INCOME		PER CAPITA PERSONAL INCOME	
	2009 TOTAL	AVG ANNUAL GROWTH (1999-2009)	2009 TOTAL	AVG ANNUAL GROWTH (1999-2009)
Boulder	\$14.6B	3.4%	\$48,056	+2.8%
Broomfield	\$2.1B	n/a	\$37,135	n/a
Jefferson	\$24.6B	3.0%	\$45,834	+2.8%

Land Ownership

The existing administrative boundary of the Refuge includes 6,240 acres of Federally-owned land, part of which is managed by the Service and part of which is managed by DOE. A substantial portion of the

subsurface mineral rights on DOE-managed land within the Refuge acquisition boundary is privately owned or encumbered by leases. Existing Service policy states that it will not accept the transfer of jurisdiction from DOE if the land is subject to the mining of gravel or other aggregate materials. There are currently efforts underway to acquire mineral rights to the areas within the Refuge acquisition boundary.

Section 16

The State of Colorado currently owns section 16, including the 617 acres that have been proposed for exchange, and the land is managed by the State Land Board. Portions of section 16 have been mined for clay and aggregates and most of the land is leased for grazing livestock.

Land Ownership at Other Potential Refuge Expansion Sites within Colorado

There are two options under consideration for adding lands to existing wildlife refuges in the State of Colorado at either the Arapaho NWR in Jackson County or the Baca NWR in Alamosa and Saguache Counties.

- The 3,687-acre land holding within the Arapaho NWR is available for purchase from a private land owner, and represents the largest remaining inholding within the Refuge's acquisition boundary.
- A portion of a 103,000-acre property owned by The Nature Conservancy is within the Baca NWR's acquisition boundary, and The Nature Conservancy (TNC) has expressed an interest in conveying this property to the Service.

Property Tax

The Rocky Flats NWR is Federally owned, and section 16 area is State-owned, meaning that there are no property taxes paid on these sites, and there would be no impacts from the changing of the acquisition boundary for the Refuge. Properties that are under consideration for acquisition at other refuges in the State may involve a change in land ownership status from private to public, meaning a net loss in property tax revenues for local jurisdictions.

Public Use and Wildlife-dependent Recreational Activities

The Refuge is currently not open to the public. However, the plan for public use and recreational opportunities is defined within the Rocky Flats NWR 2004 Comprehensive Conservation Plan for the site, which outlines how visitors will access the site, what activities they will enjoy, and what facilities they will encounter.

- **Access:** Access to the site will be obtained via a two-lane road off SH 93. The access road will direct visitors to orientation information, trailheads and parking areas. To tie into surrounding existing and proposed trail systems, additional trailheads will be built on the north, east, and south boundaries of the Refuge. Strategically located to provide links to proposed trail networks, the secondary access points along the Refuge boundary will permit visitors to enter the site on foot, bike, and in some cases by horse.

The Refuge will remain open from sunrise to sunset. Since visitors will be able to enter the site from a number of access points, each entry will serve as a “use portal” where signage will inform users about the distinction between where they came from (e.g., municipal open space) and where they are going (a National Wildlife Refuge). In addition to clarifying access opportunities and restrictions as well as information on the site’s history and cleanup, the signage will inform visitors about the conservation practices and priorities that may differ from those of surrounding open space areas.

- **Wildlife-Dependent Public Uses:** The Refuge will provide a spectrum of wildlife recreation opportunities ranging from guided tours, to hiking, to interactive interpretation programs. Visitors will explore and learn about the site independently with the aid of interpretive facilities including signage, kiosks, and printed materials. Through the careful siting of trails and the design of visitor use facilities, it will be possible to shape the Refuge environment so that it invites exploration and reveals natural processes while minimizing impact to sensitive areas. Interpretive and educational programs will promote appreciation of the ecology of the prairie environment and inspire a greater appreciation for the Front Range’s remaining grassland habitat. Dogs and other pets will not be permitted on the Refuge. The visitor experience will include opportunities for the public to engage in wildlife observation, photography, interpretation, environmental education, and possible hunting. The public use activities will be carefully managed to avoid harmful impacts to wildlife and their habitat. Because the Service will focus on restoration and facility development during the first 5 years of Refuge operation, most of these activities will not be instituted until the Refuge is fully open to the general public.
- **Facilities:** Facility development will carefully balance habitat conservation with opportunities for visitors to explore the prairie. Facility development will include trails, trailheads (with portable restrooms) overlooks, information kiosks, viewing blinds, contact station (with restrooms) and parking areas. Initially, the site will only be open to the general public at scheduled times and only one trail (1.75 miles) to Lindsay Ranch will be open to pedestrians. The initial trail will extend from the parking area to the Rock Creek overlook and make a loop within the Rock Creek drainage. Outlined below are all facilities that will be developed and open to the public once adequate funding is available to manage the refuge for public access:
 - Trails: Approximately 12.8 miles of multi-use trails and 3.8 miles of pedestrian-only trails will be developed. The majority of the trails will follow converted road corridors away from riparian areas. Trails within the Rock Creek drainage and other sensitive areas will be subject to seasonal closures as needed to protect wildlife. Looped pedestrian-only and multi-use trails as well as connections to adjacent trail systems will accommodate a variety of trail users.
 - Kiosk: Within a kiosk located outside the contact station, visitors will find maps of the trail system, rules and regulations, and information on Refuge wildlife and habitat. The kiosk will consist of three sign panels hung on a wooden structure. The kiosk will be accessible to all visitors when the contact station is closed. During the early years of visitor use of the refuge before development of the contact station and when access is limited, the kiosk will provide information on current and future public use opportunities.

- Equestrian Uses: Only multi-use trails in the southern portion of the site will be open to equestrian uses. Hitching posts will be located near the contact station, allowing equestrian users to hike to Lindsay Ranch.
- Trailheads: All entries to the Refuge trail system will be posted with signage that clearly demarcates the visitor's entry into a National Wildlife Refuge.
- Overlook: Three overlooks will provide views of the site and the outlying landscape. The overlooks will be simple and designed to fit into the prairie landscape. They will likely entail a graded, gravel area sited for its nearby and distant views. The Rock Creek and SH 128 overlooks will feature interpretive sign panels. Benches at the Woman Creek and Rock Creek overlooks will provide a resting point for visitors.
- Blinds: Wildlife viewing blinds will be sited to optimize observation opportunities. The blinds will be designed to blend in with the surrounding landscape and minimize disturbances to wildlife.
- Parking: Four parking areas (spaces for about 54 cars and one bus) will be constructed. The largest parking lot (30 spaces) will be located at the entry drive terminus, adjacent to the contact station. This main parking area will be designed to accommodate horse trailers. An additional parking lot (20 spaces) will be situated on the site's northern edge with convenient access from Highway 128. Pull-offs along the main access road, south of the visitor contact station, and along Indiana Street will provide additional parking spaces (3 to 4 spaces each) for visitors using trails in the southern portion of the Refuge. All parking areas will be gravel and will be enclosed by a post and beam fence.
- Contact Station: A small structure (approximately 750 to 1,000 square feet) will house an interpretive display and staff office space. The contact station will be the primary orientation point for visitors where they will collect information about the Refuge. The station also will serve as the meeting ground for guided tours and other Refuge programs. Located outside the main parking area, the contact station will be staffed seasonally (e.g., weekends from May through October), to provide visitor contact with Refuge staff.